Attachment B:
Technical Evaluation: Mobile Source Air Toxics (MSATs)

MOBILE SOURCE AIR TOXICS: BACKGROUND

The purpose of this document is to evaluate the emissions of mobile source air toxic (MSAT) associated with the North Spokane Corridor project. The analysis includes the MSAT emissions of both the portion of the project funded by the recent TIGER grant, and the project as a whole.

There are no Nationally Ambient Air Quality Standards (NAAQS) established for air toxics, as there are for the criteria pollutants (carbon monoxide, ozone, particulate matter, etc.) Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments of 1990, whereby Congress mandated that the U.S. Environmental Protection Agency (EPA) regulate 188 air toxics, also known as hazardous air pollutants. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (http://cfcpub.epa.gov/ncea/iris/index.cfm). In addition, EPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (http://www.epa.gov/ttn/atw/nata1999/). These are *acrolein, benzene, 1,3-butadiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter.* While FHWA considers these the priority mobile source air toxics, the list is subject to change and may be adjusted in consideration of future EPA rules.

The 2007 EPA rule mentioned above requires controls that will substantially decrease MSAT emissions through cleaner fuels and cleaner engines (http://www.epa.gov/otaq/regs/toxics/420f07017.pdf). According to an FHWA analysis using EPA's MOBILE6.2 model, even if vehicle activity (vehicle-miles travelled, VMT) increases by 145 percent as assumed, a combined reduction of 72 percent in the total annual emission rate for the priority MSAT is projected from 1999 to 2050, as shown in Figure 1.

ANALYSIS OF MSAT IN NEPA DOCUMENTS

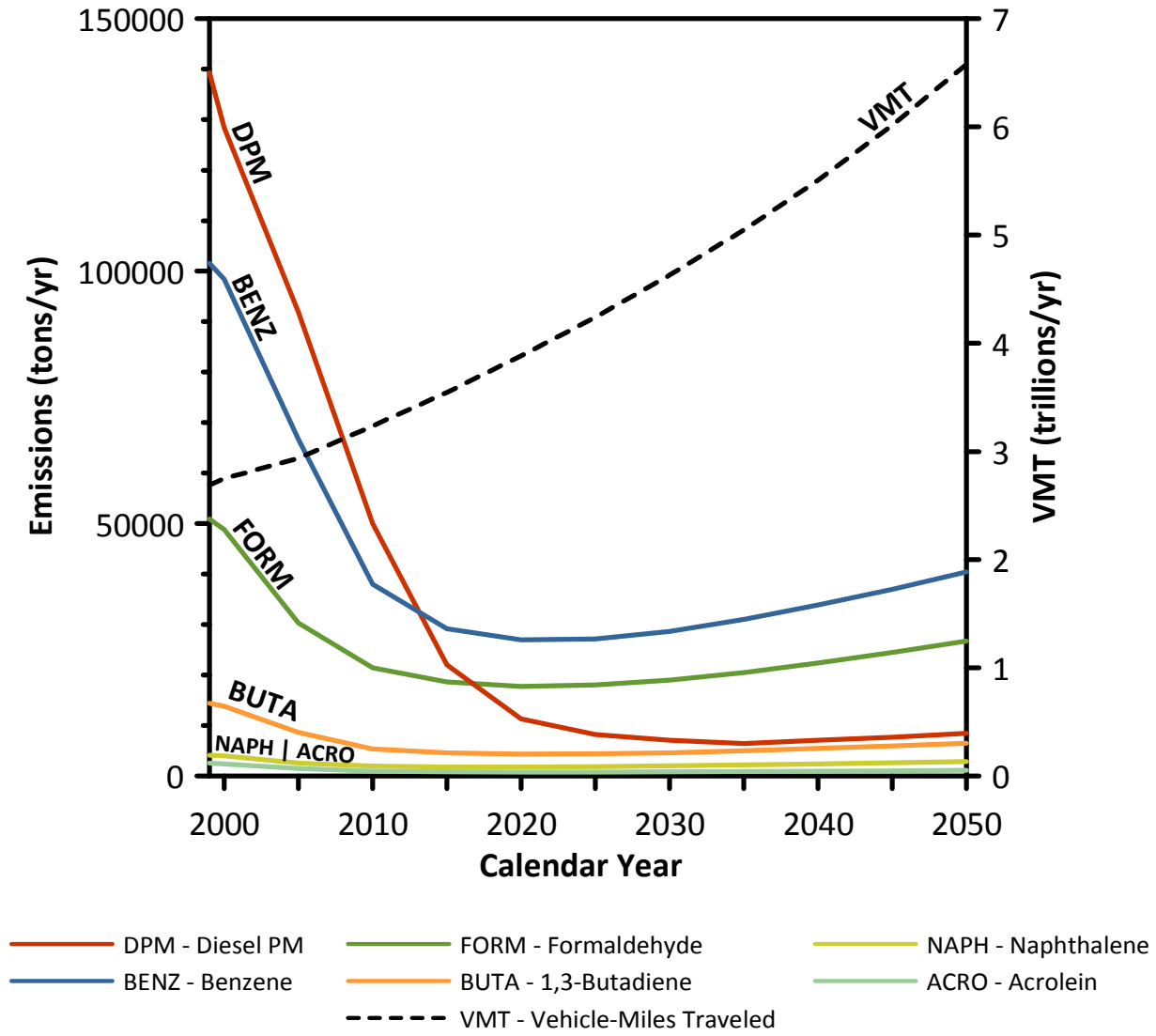
FHWA issued guidance in 2006 for analysis of MSATs from highway projects, and updated this guidance in 2009 (FHWA's Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents, http://www.fhwa.dot.gov/environment/airtoxic/100109guidmem.pdf). FHWA has developed a tiered approach for analyzing MSAT in NEPA documents, depending on specific project circumstances. FHWA has identified three levels of analysis:

1) No analysis for projects with no potential for meaningful MSAT effects;

2) Qualitative analysis for projects with low potential MSAT effects; or

3) Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.

Figure 1: NATIONAL MSAT EMISSION TRENDS 1999 – 2050 FOR VEHICLES OPERATING ON ROADWAYS USING EPA's MOBILE6.2 MODEL



Notes: 1) Annual emissions of polycyclic organic matter are projected to be 561 tons/yr for 1999, decreasing to 373 tons/yr for 2050.
2) Trends for specific locations may be different, depending on locally derived information representing vehicle-miles travelled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors.

Source: FHWA analysis based upon MOBILE6.2 model run dated 20 August 2009, in support of FHWA's 2009 MSAT guidance revision (http://www.fhwa.dot.gov/environment/ airtoxic/100109guidmem.pdf).

The types of projects included in the first category are:

- Projects qualifying as a categorical exclusion under 23 CFR 771.117(c);
- Projects exempt under the Clean Air Act conformity rule under 40 CFR 93.126; or
- Other projects with no meaningful impacts on traffic volumes or vehicle mix.

The second category of projects includes those that serve to improve operations of highway, transit or freight without adding substantial new capacity or without creating a facility that is likely to meaningfully increase MSAT emissions. This category covers a broad range of projects. Most highway projects that need an MSAT assessment fall into this category. Examples of these types of projects are minor widening projects; new interchanges, such as those that replace a signalized intersection on a surface street; or projects where design year traffic is projected to be less than 140,000 to 150,000 AADT.

The third category includes projects that have the potential for meaningful differences in MSAT emissions among project alternatives. To fall into this category, a project could:

- Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel particulate matter in a single location; or
- Create new or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the AADT is projected to be in the range of 140,000 to 150,000[1] or greater by the design year;

  And also

- Proposed to be located in proximity to populated areas.

The North Spokane Corridor project falls into this category of projects because of the traffic volumes associated with the project. The projected design year (2030) traffic volumes near the south end of the project of 262,800 vehicles per day at the intersection with I-90 exceed the 140,000 to 150,000 AADT threshold in FHWA's guidance. As a result, a quantitative MSAT emissions analysis was completed for the project.

[1] Using EPA's MOBILE6.2 emissions model, FHWA staff determined that this range of AADT would be roughly equivalent to the Clean Air Act definition of a major hazardous air pollutant (HAP) source, i.e. 25 tons/yr for all HAPs or 10 tons/yr for any single HAP.

PROJECT-SPECIFIC MSAT EMISSIONS

When conducting MSAT emissions analysis, FHWA generally estimates emissions in multiple calendar years. First, FHWA estimates emissions for a base year (in this case, 2008). This provides reviewers with an estimate of emissions that the population affected by the project is currently experiencing. Next estimates of emissions in the future project design year (2030 in this case), both with and without the project, are made. This comparison between existing conditions, future build, and future no-build enables reviewers to see the overall trend in emissions over time, and to understand how much difference the project makes in overall emissions levels. For the North Spokane Corridor project, FHWA also completed a third analysis to evaluate the portion of the project to be funded by the TIGER grant.

The emissions analysis begins with the identification of an affected transportation network. The affected network is the portion of the overall Spokane roadway network where traffic volumes and speeds would be affected by the proposed project. FHWA used a total of five transportation network scenarios: a 2008 baseline network**;** a 2030 network without the project**;** a 2030 network with the completed project**;** a 2012 network without the TIGER grant portion of the project (but with the portions of the project that are currently in operation)**;** and a 2012 network with the TIGER portion of the project in place[2]. (While maps of these specific networks are not available, maps of the NSC project area are included in Figures 2a and 2b. Figure 2a shows the location of the TIGER grant portion of the project.) Once the necessary travel data were compiled, FHWA used EPA's MOBILE6.2 emissions factor model to estimate emissions for each network. MOBILE6.2 is an emissions model created by EPA and used in all states (except for California) for emissions analysis of motor vehicles, including MSATs. To the extent possible, the MOBILE6.2 inputs used in this MSAT analysis are consistent with those used by the state and local air agencies and the SRTC in other local analyses. The Washington State Department of Transportation (WSDOT), the Washington Department of Ecology, and the Spokane Regional Transportation Council (SRTC) provided the traffic data and local MOBILE6.2 inputs used in this analysis.

The results of the MSAT emissions analysis are presented in Figure 3. A discussion of the emission levels associated with each project scenario follows.

[2] The 2030 no-build network does assume that the existing operating segments of the project will remain in place, and also assumes that the near-term portion of the project funded by the TIGER grant would be completed.

Figure 2a: NORTHERN PORTION OF THE NSC PROJECT, INCLUDING THE TIGER PORTION

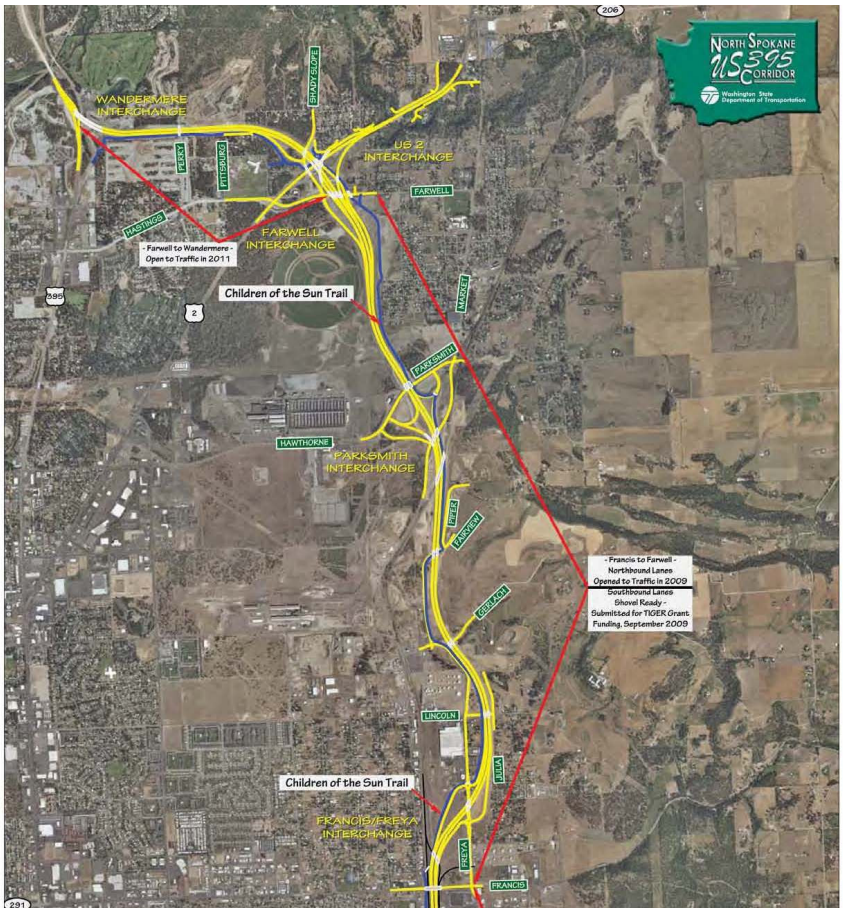


Figure 2b: MAP OF THE SOUTHERN PORTION OF THE NSC PROJECT

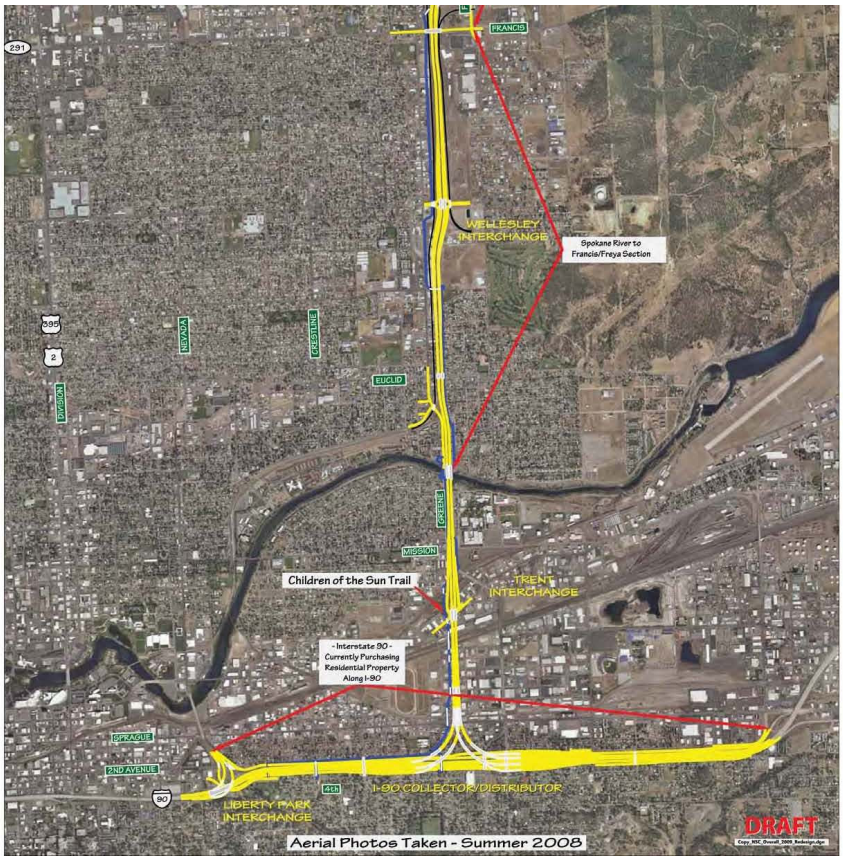
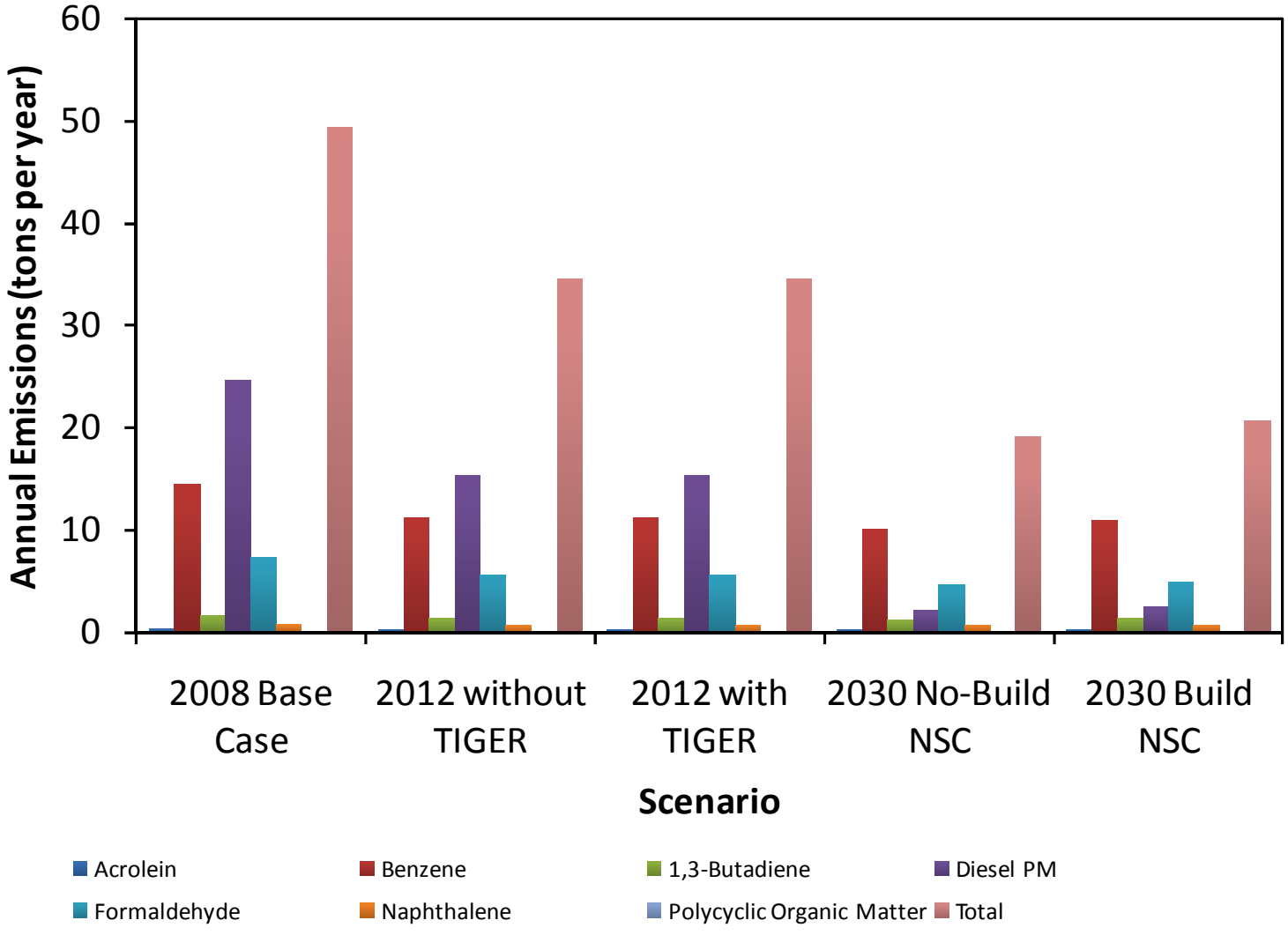


Figure 3: PROJECT-SPECIFIC MSAT EMISSION TRENDS



1) MSAT emissions trends for the entire NSC Project as a whole

Total MSAT emissions in the project area are estimated to decline by approximately 61% between the 2008 Base Case and the 2030 No-Build scenario (Table 1). Especially large reductions are seen for diesel particulate matter, which is classified as a probable human carcinogen by EPA, and benzene, which is a known carcinogen. These reductions are primarily due to EPA's motor vehicle and fuel control programs. The Build scenario has total MSAT emissions that are almost 8% higher than No-Build, but this emissions level is still 58% lower than current (2008) levels.

Table 1. Entire Project MSAT Emissions

MSAT Emissions		2008 Base Case	2030 No-Build NSC	2030 Build NSC
Acrolein	ton/yr	0.35	0.23	0.25
Benzene	ton/yr	14.47	10.18	10.96
1,3-Butadiene	ton/yr	1.63	1.23	1.33
Diesel PM	ton/yr	24.73	2.23	2.49
Formaldehyde	ton/yr	7.34	4.66	4.96
Naphthalene	ton/yr	0.78	0.60	0.66
Polycyclic Organics	ton/yr	0.10	0.08	0.09
Total	ton/yr	49.41	19.21	20.74

2) MSAT emissions trends for the TIGER portion of the NSC Project

Table 2 presents the emissions differences resulting from the portion of the project funded by the TIGER grant. There is essentially no difference in emissions between the Build and No Build conditions for this portion of the project, because of the small changes in overall traffic volumes across the transportation network. (The TIGER grant portion of the project will expand the existing operating segment of the NSC project from 3 lanes to 6 lanes. Motorists already using the roadway will have access to additional lanes, but major regional shifts in traffic patterns are not expected.) However, total MSAT emissions in 2012 are approximately 30% lower than 2008 levels in both scenarios. This is due to large reductions in benzene and diesel particulate emissions resulting from EPA's emissions control programs. The reduction trend is not as large because a shorter time period was analyzed (4 years instead of 22 years) to reflect the quicker completion of this part of the overall NSC project.

Table 2. MSAT Emissions from the TIGER Grant portion of the NSC Project

MSAT Emissions		2008 Base Case	2012 without TIGER	2012 with TIGER
Acrolein	ton/yr	0.35	0.27	0.27
Benzene	ton/yr	14.47	11.25	11.24
1,3-Butadiene	ton/yr	1.63	1.38	1.38

Diesel PM	ton/yr	24.73	15.35	15.33
Formaldehyde	ton/yr	7.34	5.55	5.55
Naphthalene	ton/yr	0.78	0.68	0.68
Polycyclic Organics	ton/yr	0.10	0.09	0.09
Total	ton/yr	49.41	34.57	34.54

3) Uncertainties associated with the MSAT analysis

The emission estimates presented in this analysis are accurate to the extent that the input data and tools used to develop them are accurate. Uncertainties exist with respect to the following:

- Future travel forecasts, due to the difficulty of projecting future levels of travel activity (which are a function of population and economic growth, fuel prices, and other factors).
- Future travel speed estimates, due to the difficulty of estimating future levels of congestion (which are a function of the amount of total travel and the amount of roadway infrastructure that will be constructed in future years).
- Emissions rates: the emissions estimates come from EPA's MOBILE6.2 model, not actual measurements of current or future vehicle emissions. One known uncertainty with MOBILE6.2 includes a lack of speed corrections for diesel particulate matter emissions factors (such that the effects of congestion or congestion relief cannot be accounted for).
- Benzene emissions estimates: MOBILE6.2 does not fully account for the benzene emissions reductions from EPA's 2007 MSAT rule (the new requirements for a reduction in the benzene content of gasoline were included in this analysis, but the effects of the new emissions control requirements for vehicles cannot be modeled in MOBILE6.2). The result is that benzene emissions estimates presented above may be conservative (high). The 2012 and 2030 emissions estimates also do not account for any MSAT emissions benefits from tighter light duty fuel economy standards.
- Additional uncertainties associated with MOBILE6.2 are discussed below.

While the results of the analysis predict a considerable decrease in MSAT emissions over time, a smaller decrease can be expected if the North Spokane Corridor project is built (58% decrease) than if it is not built (61% decrease). However, it is difficult to determine the potential health impacts of this difference in emissions. While there have been studies attempting to find a causation between MSAT emissions and health effects, there is no study that shows correlations to specific MSAT compounds at current environmental concentrations. According to the Health Effects Institute in their special report of mobile source air toxics (http://pubs.healtheffects.org/view.php?id=282), "(b)ecause exposures to MSATs occur as part of complex mixtures (which can also include non-MSAT compounds), it is especially difficult to deconvolute the contributions of any given compound to human health risks". Accordingly, when the science is incomplete or unavailable, 40 CFR 1502.22 provides instruction.

CEQ PROVISIONS COVERING INCOMPLETE OR UNAVAILABLE INFORMATION (40 CFR 1502.22)

Sec. 1502.22 INCOMPETE OR UNAVAILABLE INFORMATION

When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking.

a) *If the incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement.*

b) *If the information relevant to reasonably foreseeable significant adverse impacts cannot be obtained because the overall costs of obtaining it are exorbitant or the means to obtain it are not known, the agency shall include within the environmental impact statement:*

    1. *a statement that such information is incomplete or unavailable;*
    2. *a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;*
    3. *a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment; and*
    4. *the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the purposes of this section, "reasonably foreseeable" includes impacts that have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.*

c) *The amended regulation will be applicable to all environmental impact statements for which a Notice to Intent (40 CFR 1508.22) is published in the Federal Register on or after May 27, 1986. For environmental impact statements in progress, agencies may choose to comply with the requirements of either the original or amended regulation.*

INCOMPLETE OR UNAVAILABLE INFORMATION FOR PROJECT-SPECIFIC MSAT HEALTH IMPACTS ANALYSIS

Existing information is currently incomplete or unavailable to credibly predict the project-specific health impacts due changes in MSAT emissions associated with a

proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSATs. EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System, which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects" (EPA, https://www.epa.gov/iris/). Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSATs, including the Health Effects Institute (HEI). Two HEI studies are summarized in Appendix D of FHWA's Interim Guidance. These two HEI reports provide an objective, comprehensive review and synthesis of more than 1000 studies to summarize the health effects of exposure to MSAT compounds of concern and traffic-related air pollution. Among the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations (HEI, http://pubs.healtheffects.org/view.php?id=282) or in the future as vehicle emissions substantially decrease (HEI, http://pubs.healtheffects.org/view.php?id=306). According to the HEI from their special report on mobile source air toxics:

> "Tools and techniques for assessing project-specific health effects of mobile-source air toxics (MSATs) are very limited. Indeed, there are substantial uncertainties about the health effects of ambient levels of air toxics in general, irrespective of their source allocation. While acknowledging these uncertainties, the U.S. Environmental Protection Agency (EPA), in its model-based National Air Toxics Assessment (NATA), estimated that 92% of the U.S. population is at some increased risk for adverse effects on the respiratory system (including irritation and other effects) because of exposure to air toxics from outdoor sources. The NATA also estimated that, in most of the U.S., people have a slightly increased lifetime risk of cancer from air toxics (between 1 and 25 in a million) if they are exposed to 1999 concentrations of these pollutants over the course of their lifetimes."

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts – each step

in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable. The results produced by EPA's MOBILE6.2 model, the California EPA's Emfac2007 model, and EPA's MOVES2010 model[3] in forecasting MSAT emissions are highly inconsistent. Although not yet approved for use in project-level analysis, preliminary indications from the development of the MOVES model are that MOBILE6.2 significantly underestimates diesel particulate matter (PM) emissions and significantly overestimates benzene emissions.

Regarding air dispersion modeling, an extensive evaluation of EPA's current regulatory CAL3QHC model was conducted in an NCHRP study (http://www.epa.gov/scram001/dispersion_alt.htm#hyroad), which documents poor model performance at ten sites across the country – three where intensive monitoring was conducted plus an additional seven with less intensive monitoring. The study indicates a bias of the CAL3QHC model to overestimate concentrations near highly congested intersections and underestimate concentrations near uncongested intersections. The consequence of this is a tendency to overstate the air quality benefits of mitigating congestion at intersections. Such poor model performance is less difficult to manage for demonstrating compliance with NAAQS for relatively short time frames than it is for forecasting individual exposure over an entire lifetime, especially given that some information needed for estimating 70-year lifetime exposure is unavailable. It is particularly difficult to reliably forecast MSAT exposure near roadways, and to determine the portion of time that people are actually exposed at a specific location.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population, a concern expressed by HEI (http://pubs.healtheffects.org/view.php?id=282). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. EPA (http://www.epa.gov/risk/basicinformation.htm#g) and the HEI (http://pubs.healtheffects.org/getfile.php?u=395) have not established a basis for quantitative risk assessment of diesel PM in ambient settings.

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by EPA as provided by the Clean Air Act to determine

[3] MOVES2010 is described at http://www.epa.gov/otaq/models/moves/index.htm. While EPA released the MOVES model in December 2009 to replace the MOBILE6.2 model, the agency has yet to release final quantitative modeling guidance or approve MOVES for project level quantitative analysis. Additionally, quality-assured local input data for use with MOVES has not been developed by the MPO or the state or local air agencies, and was therefore not available at the time of the analysis.

whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine a "safe" or "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA's approach to addressing risk in its two step decision framework. Natural Resources Defense Council v. EPA, 529 F. 3d 1077, 1080 (D.C. Cir. 2008). Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than safe or acceptable.

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

CONCLUSION

FHWA conducted an MSAT emissions analysis for the North Spokane Corridor project, following the procedures outlined in its 2009 MSAT guidance. The analysis concludes that reductions in MSAT emissions will occur in the project area regardless of whether the project is constructed. Small differences in emissions occur between the Build and No-Build scenarios. Compared to 2008 levels, emissions are reduced by 58% in the Build scenario, and 61% in the No-Build scenario. As discussed above, uncertainties in available information and tools preclude FHWA from being able to estimate the health impacts of this small difference in emissions. Also, essentially no change in emissions was found with respect to building or not building the portion of the project funded by the TIGER grant.